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Particle transport in a wave spectrum with a thermal distribution of Larmor radii[1] JULIO MARTINELL, NIKOLAY KRYUKOV, ICN-UNAM, DIEGO DEL CASTILLO-NEGRETE, ORNL — Test particle $\mathbf{E} \times \mathbf{B}$ transport is studied due to an infinite spectrum of drift waves in two dimensions using a Hamiltonian approach, which can be reduced to a 2D mapping. Finite Larmor radius (FLR) effects are included taking a gyroaverage. When the wave amplitude is increased there is a gradual transition to chaos but the chaos level is reduced when FLR grows, implying that fast particles are better confined. The fraction of confined particles is found to be reduced as the wave amplitude rises. The statistical properties of transport are studied finding that, in the absence of a background flow, it is diffusive with a Gaussian PDF, when all particles have the same FLR. In contrast, for a thermal FLR distribution, the PDF is non-Gaussian but the transport remains diffusive. A theoretical explanation of this is given showing that a superposition of Gaussians produces a PDF with long tails. When a background flow is introduced that varies monotonically with radius, the transport becomes strongly super-diffusive due to the appearance of long Levy flights which dominate the particles. The PDF develops long tails as the flow strength is increased. The particle variance scales as $\sigma \sim t^3$ for chaotic regime but reduces to ballistic ($\sim t^2$) for low chaos.

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